Appendix A: Radio & Satellite Navigation Grid

NAVIGATION SYSTEM	FREQUENCY BAND	FREQUENCY RANGE	KEY CONCEPT
VOR	VHF	108.0-117.95 MHz	360 MAG RADIALS
TACAN	UHF	960-1215 MHz	360 MAG RADIALS + DME
DME	UHF	962-1213 MHz	TRANSPONDER ON GROUND
VORTAC	VHF/UHF		COMBINED VOR & TACAN
RNAV (CLC)			COURSE LINE COMPUTER "OFFSETS" NAVAID WAYPOINT MUST BE WITHIN NAVAID RECEPTION RANGE
INS			SELF CONTAINED
NDB	L/MF	190-535 KHz	LEAST ACCURATE/LIGHTNING PRECIPITATION STATIC
ILS	LOC - VHF, GS- UHF	LOC - 108.10-111.95 MHz GS - 329.15-335.0 MHz	BOTH HORIZONTAL AND VERTICAL GUIDANCE. NDB USED WITH MARKER BEACON IS COMPASS LOCATOR
GPS			3 SATELLITES FOR TWO DIMENSION 4 SATELLITES FOR THREE DIMENSIONS

Appendix B: The Instrument Landing System

VHF Localizer

Runway length

250' to 600'

7,000' (typical)

from centerline of runway

Sited to provide 55' (±5') runway threshold

crossing height

Provides horizontal guidance 108.10 to 111.95 MHz. Radiates about 100 watts. Horizontal polarization. Modulation frequencies 90 and 150 Hz. Modulation depth on course 20% for each frequency. Code Identification (1020 Hz, 5%) and voice communication (modulated 50%) provided on same channel.

ILS approach charts should be consulted to obtain variations of individual systems.

1,000' typical. Localizer transmitter building is offset 250' minimum from center of antenna array and within 90° ±30° from approach end. Antenna is on centerline and normally is under 50/1 clearance Point of intersection runway and glide slope extended.

Middle Marker

height point

90 Hz

150 Hz

90 Hz

Glide slope modulation

frequency

Indicates approximate decision

Keying: 95 alternate dot & dash combinations/minute

Amber Light

150 Hz

Modulation 1,300 Hz, 95%

Localizer modulation



Flag indicates if facility not on the air or receiver malfunctioning

Outer Marker

Provides final approach fix for nonprecision approach Modulation 400 Hz, 95%

Keying: Two dashes/second

Blue Light

UHF Glide-slope Transmitter Provides vertical guidance 329.3 to 335.0 MHz. Radiates about

5 watts. Horizontal polarization, modulation on path 40% for 90 Hz and 150 Hz. The standard glide-slope angle is 3.0 degrees. It may be higher depending on local terrain.

> Outer marker located 4 to 7 miles from end of runway, where glide slope intersects the procedure tum (minimum holding) altitude, ±50' vertically.

3 000' to 6 000'

from threshold

X*200

Rate of Descent Chart (feet per minute)

Speed	Angle			
(Knols)	2.5°	2.75°	3°	
90	400	440	475	
110	485	535	585	
130	575	630	690	
150	665	730	795	
160	707	778	849	

Compass locators, rated at 25 watts output 190 to 535 KHz, are installed at many outer and some middle markers. A 400 Hz or a 1020 Hz tone, modulating the carrier about 95%, is keyed with the first two letters of the ILS identification on the outer locator and the last two letters on the middle locator. At some locations, simultaneous voice transmissions from the control tower are provided, with appropriate reduction in identification percentage.

*Figures marked with asterisk are typical. Actual figures vary with deviations in distances to markers, glide angles and localizer widths.

All marker transmitters

approximately 2 watts of 75

MHz modulated about 95%.

Approximately 1.4° width (full scale limits.)

0.7°

3° above horizontal

(optimum)

(approx.)

Course width varies between 3° to 6° tailored to provide 700' at threshold

(full scale limits)